

Internationally recognized guidelines for ‘sensible’ alcohol consumption: is exceeding them actually detrimental to health and social circumstances? Evidence from a population-based cohort study

G. David Batty^{1,2,3}, Heather Lewars¹, Carol Emslie¹, Catharine R. Gale^{2,4}, Kate Hunt¹

¹Medical Research Council Social and Public Health Sciences Unit, University of Glasgow, 4 Lilybank Gardens, Glasgow G12 8RZ, UK

²Centre for Cognitive Ageing and Cognitive Epidemiology, Department of Psychology, University of Edinburgh, Edinburgh, UK

³The George Institute for International Health, University of Sydney, Sydney, Australia

⁴Medical Research Council Epidemiology Resource Centre, University of Southampton, Southampton General Hospital, Southampton, UK

Address correspondence to David Batty, E-mail: david-b@sphsu.mrc.ac.uk

ABSTRACT

Background The health and social impact of drinking in excess of internationally recognized weekly (>21 units in men; >14 units in women) and daily (>4 units in men; >3 units in women) recommendations for ‘sensible’ alcohol intake are largely unknown.

Methods A prospective cohort study of 1551 men and women aged around 55 years in 1988 when typical alcohol consumption was recalled using a 7-day grid. An average of 3.4 years later (1990/92), study participants were re-surveyed ($n = 1259$; 84.7% of the target population) when they responded to nurse-administered enquiries regarding minor psychiatric morbidity, self-perceived health, hypertension, accidents, overweight/obesity and financial difficulties. Study members were followed up for mortality experience over 18 years.

Results In fully adjusted analyses, surpassing guidelines for sensible alcohol intake was associated with an increased risk of hypertension [daily guidelines only: P -value(trend): 0.012], financial problems [weekly guidelines: P -value(difference): 0.046] and, to a lesser degree, accidents [weekly guidelines: P -value(difference): 0.065]. There was no association between either indicator of alcohol intake and mortality risk.

Conclusions In the present study, there was some evidence for a detrimental effect on health and social circumstances of exceeding current internationally recognized weekly and daily guidelines for alcohol intake.

Keywords alcohol, alcohol consumption, epidemiology

Introduction

With around 90% of adults in the UK and many other countries reporting that they drink alcohol regularly,^{1,2} guidance on appropriate intake has been widely disseminated. Current recommendations for ‘sensible’ weekly consumption (up to 21 units in men, 14 units in women) were first advanced by the *Royal College of Physicians*³ over two decades ago (in the UK, 1 unit of alcohol corresponds to 8 g of ethanol). Support by other agencies,⁴ including the *British Medical Association*,⁵ rapidly led to official adoption by the UK government,⁶ the Scandinavian nations and Australia.

These guidelines are based on a large body of research finding a ‘U’- or ‘J’-shaped association between alcohol intake and both all-cause and coronary heart disease (CHD)

mortality.^{7–12} That is, although abstainers and heavy consumers experience elevated risk, moderate drinkers do not. However, with different studies inevitably defining alcohol intake in different ways, arrival at a single, clear recommendation for optimal consumption is problematic and has led to recent controversy.¹³ Nonetheless, scientific committees, including those representing the Department of Health, have indicated that drinking beyond these weekly limits is

G. David Batty, Wellcome Trust Fellow

Heather Lewars, Research Assistant

Carol Emslie, Research Scientist

Catharine R. Gale, Principal Research Fellow

Kate Hunt, Professional Fellow

harmful to human health,¹⁴ and that, more specifically, exceeding the more recently proposed daily benchmark of 4 units (men) and 3 units (women) carries ‘... an increasingly significant risk of illness and death from a number of conditions...’.¹⁵ A negative impact on social outcomes, including family breakdown and financial hardship, has also been suggested.¹⁶

Despite the long-standing nature of the weekly guidelines for sensible consumption of alcohol, and the wealth of data relating alcohol intake to health outcomes from which it may be possible to indirectly infer the health consequences of specific doses of alcohol intake,^{7–12} to our knowledge, the impact of drinking in excess of either set of guidelines on later health and social circumstances has yet to be carefully examined. This is a particularly important public health question since over half of the adult population of England report drinking in excess of the new daily guidelines.¹ The corresponding prevalence is as high as two-thirds of adults in Scotland,¹⁷ from where the present study population is drawn.

Methods

Study participants are from the West of Scotland *Twenty-07 Study*, a population-sampled cohort designed to investigate the influence of social factors on health. The design and sampling have been described in detail elsewhere.^{18,19} In brief, the *Twenty-07* study comprises three cohorts of men and women recruited at around ages 15, 35 and 55 years in 1988. Our analyses are based on data for the oldest age group collected by trained nurse interviewers in the homes of study participants in 1988 ($n = 1551$; 87.7% of the target population) and again at follow-up in 1990/92 ($n = 1259$; 84.7% of the baseline population). We also utilized cause of death data from routine mortality surveillance over an 18-year period.

Assessment of alcohol consumption

Study participants provided a recall of their alcohol consumption over each of the 7 days preceding the interview, reporting separately for five categories of alcohol: beer (including lager and cider), wine, fortified wine, spirits and ‘other’ (e.g. ‘alcopops’). Responses were expressed in units which represent 8 g of pure alcohol equivalent to half a pint of ordinary beer, lager or cider, a small glass of wine or a single measure of spirits. For weekly alcohol intake, data were totalled and respondents were dichotomized on the basis of whether or not they exceeded the recommendations for sensible weekly intake if they consumed more than 21 units (men) or 14 units (women).⁷ For daily intake, the

number of days in the preceding 7 on which a study participant exceeded 4 units (men) and 3 units (women)¹⁵ was computed. Responses were categorized into three groups: 0, 1 or 2+ days.

Assessment of health and social outcomes

A 12-item version of the General Health Questionnaire²⁰ was used to provide an indication of minor psychiatric illness, with a score of 3 or more symptoms used to denote a ‘case’. Self-assessed health was derived from a standard enquiry: ‘Thinking about your health in general as it is now, would you say that for someone of your age your health is excellent, good, fair or poor?’ (dichotomized as: excellent/good; fair/poor). Using existing guidelines,²¹ study members were classified as stage 1 hypertensive or above if their measured blood pressure exceeded 140 mmHg (systolic) and 90 mmHg (diastolic), and/or they indicated to the nurse that they were taking blood pressure-lowering medication. Enquiries were also made about accidents or injuries that required medical or surgical attention. Body mass index (BMI) (kg/m^2) was calculated from height and weight which were measured using standard protocols;²² a cut-off of $25 \text{ kg}/\text{m}^2$ was used to denote overweight/obesity.²³ Financial difficulties were derived from the enquiry: ‘Suppose you needed to find a lump sum of money. For example, suppose a cooker or washing machine broke down and you needed £200 for a new one straight away to replace it. Would it be: no problem, inconvenient but not impossible, difficult, impossible?’ (dichotomized as: no problem/inconvenient but not impossible; difficult/impossible). Study participants were flagged with the National Health Services central registry for notification of date and cause of death. CHD was coded as 410–414.9 (ICD version 9)²⁴ or I20–I25.9 (ICD version 10)²⁵ for the main or secondary cause of death.

Assessment of covariates

Education was recorded as years spent in full time study. Head of household’s current (or last if not currently employed) occupation was coded into one of the six categories according to the Registrar General’s schema of occupational social class.²⁶ The occupation of married or cohabiting women was based on that of their partner. Smoking was grouped into former, current and never.

Statistical analyses

We used Cox’s proportional hazards regression²⁷ to examine the association of alcohol intake with total and CHD mortality by deriving a hazard ratio with 95% confidence

intervals. Survival time was censored at 1 September 2006. For other outcome variables, which were ascertained at follow-up survey, we used logistic regression analyses to compute an odds ratio and 95% confidence intervals. Reasoning that the presence of poor health or social problems might influence alcohol intake (reverse causality), all models, with the exception of accidents, were based on persons who were free of the featured outcome at baseline (i.e. did not have CHD, minor psychiatric illness, poor/fair health, hypertension, overweight/obesity and financial difficulties). The size of the final analytical sample varied depending on the extent of these exclusions, missing data and the outcome under consideration (range: 541–1449). In preliminary analyses, within the narrow age range of participants (54–58 years) in this cohort, there were unsurprisingly no associations between age and any of the health or social outcome; so, no adjustment for age was made. Although many more men than women exceeded the guidelines, there was no strong evidence that the impact of exceeding recommendations for sensible drinking was differential with respect to gender. We therefore pooled data for men and women, adjusting the effect estimates for sex and a range of other potential confounding variables.

Results

Of those people with complete data on alcohol consumption at baseline, a higher proportion of men than women exceeded both the weekly (24.5 versus 3.4) and the daily (one or more day) (50.4 versus 18.5) guidelines. During 18 years of follow-up, there were 470 deaths from all-causes in 1449 men and women; in 1280 study members who were CHD-free at

study induction, there were 113 subsequent CHD deaths. Surpassing weekly recommendations were not associated with either all-cause or CHD mortality (Table 1), although the number of deaths in some of these analyses was relatively low. However, there was some evidence of an elevated rate of all-cause and CHD mortality in people drinking more than the recommended daily level of alcohol, but this association did not persist after adjusting for covariates. When we excluded abstainers from the sample and repeated our analyses, the relation of the two alcohol variables to total and CHD mortality risk was almost identical to those in the original analyses (results not shown but available upon request).

In Tables 2 and 3, we show the relations between alcohol consumption and short-term health outcomes as assessed an average of 3.4 years (1990–92) after the baseline survey. Exceeding the recommended weekly intake was not strongly related to subsequent minor psychiatric illness, poorer self-assessed health or hypertension (Table 2). However, there was an increased prevalence of minor psychiatric disorder in people who drank more than the recommended daily guidelines on 1 day of the week, although this was not elevated further in those who did so more frequently. This association was little altered following adjustment for a range of confounding variables. Hypertension, but not poorer self-rated health, revealed a positive, stepwise association in study members who drank more than the suggested daily consumption [$P(\text{trend}) = 0.012$]. Again, this association was essentially unaffected by multiple adjustment for covariates.

There was a somewhat raised prevalence of accidents and, to a lesser degree, overweight/obesity, in men and women who drank more than the weekly alcohol

Table 1 Hazards ratios (95% confidence intervals) for the relation of weekly and daily guidelines for alcohol intake (1988) with later mortality from all-causes and CHD

		All-cause mortality			Coronary heart disease mortality		
		<i>n_{dead}/n_{risk}</i>	<i>Sex-adjusted</i>	<i>Fully adjusted</i>	<i>n_{case}/n_{risk}</i>	<i>Sex-adjusted</i>	<i>Fully adjusted</i>
Exceeding weekly guidelines	No	398/1263	1 (ref)	1	95/1114	1 (ref)	1
	Yes	72/186	1.06 (0.81, 1.37)	0.94 (0.72, 1.22)	18/166	0.90 (0.54, 1.53)	0.76 (0.45, 1.29)
<i>P</i> -value (difference)			0.691	0.623		0.706	0.316
Exceeding daily guidelines	No	276/967	1 (ref)	1	60/852	1 (ref)	1
	Yes, on 1 day	92/232	1.39 (1.09, 1.77)	1.24 (0.97, 1.58)	26/205	1.60 (1.00, 2.57)	1.40 (0.87, 2.25)
	Yes, on 2+ days	102/250	1.26 (0.99, 1.61)	1.08 (0.85, 1.38)	27/223	1.25 (0.77, 2.01)	1.02 (0.63, 1.66)
<i>P</i> -value (trend)		—	0.024	0.370	—	0.243	0.781

Fully adjusted model is adjusted for baseline sex, social class, age left school, height, BMI, smoking status and marital status. The analysis with coronary heart disease mortality as the outcome of interest is based on people who were free of the condition at baseline in 1988 and excludes two people without information on cause of death; the analytical sample is therefore reduced.

Table 2 Odds ratios (95% confidence intervals) for the relation of UK weekly and daily guidelines for alcohol intake (1988) with health outcomes (1990–92)

		<i>Minor psychiatric illness</i>			<i>Poor/fair self-assessed health</i>			<i>Hypertension</i>		
		<i>n_{cases}/n_{risk}</i>	<i>Sex-adjusted</i>	<i>Fully adjusted</i>	<i>n_{cases}/n_{risk}</i>	<i>Sex-adjusted</i>	<i>Fully adjusted</i>	<i>n_{cases}/n_{risk}</i>	<i>Sex-adjusted</i>	<i>Fully adjusted</i>
Exceeding weekly guidelines	No	147/783	1 (ref)	1	92/738	1 (ref)	1	188/510	1 (ref)	1
	Yes	23/105	1.30 (0.77, 2.20)	1.26 (0.74, 2.15)	11/105	0.76 (0.38, 1.53)	0.67 (0.33, 1.35)	25/64	1.20 (0.68, 2.13)	1.19 (0.68, 2.14)
<i>P</i> -value (difference)			0.328	0.401		0.442	0.261		0.530	0.822
Exceeding daily guidelines	No	101/587	1 (ref)	1	65/561	1 (ref)	1	139/401	1 (ref)	1
	Yes, on 1 day	42/153	1.92 (1.25, 2.94)	1.88 (1.21, 2.91)	20/143	1.23 (0.71, 2.12)	1.06 (0.60, 1.85)	33/85	1.29 (0.79, 2.10)	1.28 (0.77, 2.12)
	Yes, on 2+ days	27/148	1.18 (0.71, 1.94)	1.12 (0.67, 1.87)	18/139	1.10 (0.60, 2.01)	0.88 (0.47, 1.64)	41/88	1.89 (1.15, 3.13)	1.94 (1.16, 3.26)
<i>P</i> -value (trend)			0.157	0.259		0.624	0.753		0.012	0.012

Fully adjusted model is adjusted for baseline sex, social class, age left school, height, BMI, smoking status and marital status.

Table 3 Odds ratios (95% confidence intervals) for the relation of UK weekly and daily guidelines for alcohol intake (1988) with health and social outcomes (1990–92)

		<i>Accidents</i>			<i>Overweight/obesity</i>			<i>Financial difficulties</i>		
		<i>n_{cases}/n_{risk}</i>	<i>Sex-adjusted</i>	<i>Fully adjusted</i>	<i>n_{cases}/n_{risk}</i>	<i>Sex-adjusted</i>	<i>Fully adjusted</i>	<i>n_{cases}/n_{risk}</i>	<i>Sex-adjusted</i>	<i>Fully adjusted</i>
Exceeding weekly guidelines	No	167/1076	1 (ref)	1	103/478	1 (ref)	1	41/790	1 (ref)	1
	Yes	27/157	1.60 (0.98, 2.59)	1.59 (0.97, 2.61)	16/63	1.29 (0.68, 2.48)	1.50 (0.76, 2.94)	12/113	2.51 (1.20, 5.26)	2.24 (1.02, 4.93)
<i>P</i> -value (difference)			0.060	0.065		0.439	0.241		0.023	0.046
Exceeding daily guidelines	No	137/816	1 (ref)	1	60/361	1 (ref)	1	30/600	1 (ref)	1
	Yes, on 1 day	25/203	0.81 (0.51, 1.28)	0.81 (0.51, 1.30)	18/91	0.89 (0.50, 1.60)	0.99 (0.55, 1.81)	11/152	1.57 (0.76, 3.26)	1.49 (0.69, 3.20)
	Yes, on 2+ days	32/214	1.15 (0.73, 1.81)	1.16 (0.73, 1.85)	22/89	1.21 (0.67, 2.17)	1.48 (0.79, 2.76)	12/151	1.84 (0.87, 3.91)	1.43 (0.64, 3.21)
<i>P</i> -value (trend)			0.780	0.754		0.644	0.275		0.085	0.318

Fully adjusted model is adjusted for baseline sex, social class, age left school, height, BMI (except analyses of overweight/obesity), smoking status and marital status.

recommendations, although statistical significance was not attained (Table 3). Exceeding sensible levels for daily intake was not generally related to either of these outcomes in our analyses. The weekly benchmark for alcohol consumption was consistently related to later self-reported financial difficulties. Thus, persons drinking more than the suggested weekly cut-off had over twice the risk of such adverse experiences relative to people who stayed within the limits.

Discussion

Main finding of this study

The aim of this paper was to examine the impact on health and social outcomes of exceeding current weekly and daily guidelines for sensible alcohol consumption as promulgated by the UK government and other countries. In fully-adjusted analyses, surpassing guidelines for sensible alcohol intake were associated with an increased risk of hypertension, accidents and financial problems, although statistical significance at conventional levels was not apparent in all analyses. There was some evidence of differential effects of the two alcohol indicators on the various outcomes we examined. This may be genuine, or perhaps due to suboptimal statistical power in selected analyses.

What is already known on this topic and what this study adds

One previous study from Canada found an increased prevalence of problems in a range of 'life-areas' such as happiness, friendships and employment opportunities in people drinking more than the weekly alcohol intake guidelines.²⁸ However, interpretation of these findings is problematic because these outcomes were grouped into a single category making it impossible to identify specific social and health effects. More importantly, because this was a cross-sectional study,²⁸ it is also not possible to ascertain the direction of association—i.e. while heavy alcohol intake might lead to financial problems, ill-health or relationship breakdown, it is equally plausible that these events might themselves precipitate increased alcohol consumption. An advantage of the present study was its prospective design which allowed us to exclude from our analyses people who already had the outcomes of interest prior to the start of the study. As such, we were able to examine the influence of drinking on the onset of new events.

Limitations of this study

Other strengths of our study include the fact that the social class distribution of the study sample was very similar to a

comparable group of the local population drawn from the UK's 1991 census samples of anonymized records.²⁹ Additional evidence of the study's generalizability can be found in the replication of various established risk factor–disease associations in this cohort. For instance, established predictors of CHD (smoking, raised blood pressure³⁰), and emerging ones (common mental disorder³¹), are associated with elevated CHD rates in the present cohort.²²

The study is not of course without its limitations. First, some analyses were hampered by a low number of cases leading to reduced statistical power; for instance, we only had sufficient deaths to examine the relationship between alcohol intake and total and CHD mortality but not other causes of death. Secondly, like most epidemiological studies, we relied on a self-reported measure of alcohol intake. However, agreement between self-report and biochemical markers of alcohol intake is sufficiently high for use in population-based studies.³² Thirdly, it may be that the quantity of alcohol poured in the domestic setting—a location likely to be favoured by the middle-aged group herein—exceeds standard measures.³³ For this reason, and the secular increases in ethanol content of a standard measure of alcohol,¹⁷ we may have underestimated intake in this population. However, the extent to which this may have impacted upon the reported associations with health and social outcomes is unclear. Fourthly, information on selected health outcomes was gathered in 1990/92, and is therefore somewhat dated. While this would of course have resulted in estimates of drinking prevalence that would not be relevant for the present day, we think it is unlikely that this would render the results of the present analyses—the impact of exceeding the guidelines on health and social outcomes—as being any less pertinent than more contemporary data. Finally, although, as described, we have sampled from the general population, the age range of the cohort—around 55 years of age at study induction—is narrow. It may therefore be inappropriate to extrapolate our results beyond this demographic.

In conclusion, exceeding guidelines for sensible weekly and daily alcohol consumption appears to impact negatively on some health and social outcomes. Given the high prevalence of UK adults surpassing the guidelines—with the likelihood that the true proportion is higher—our results are of public health relevance.

Acknowledgements

We are grateful to all of the participants in the study, and to the survey staff and research nurses involved. The data are utilized here with the permission of the Twenty-07 Steering Group. During the preparation of this manuscript, K.H.,

C.E. and H.L. were employed by the Medical Research Council (WBS U.1300.00.004). G.D.B. is a UK Wellcome Trust Fellow (WBS U.1300.00.006.00012.01).

Funding

The Medical Research Council (MRC) Social and Public Health Sciences Unit receives funding from the UK MRC and the Chief Scientist Office at the Scottish Government Health Directorates. The Centre for Cognitive Ageing and Cognitive Epidemiology is supported by the Biotechnology and Biological Sciences Research Council, the Engineering and Physical Sciences Research Council, the Economic and Social Research Council, the Medical Research Council and the University of Edinburgh as part of the cross-council Lifelong Health and Wellbeing initiative. The West of Scotland Twenty-07 Study is funded by the UK Medical Research Council; the data were originally collected by the MRC Social and Public Health Sciences Unit. Funding to pay the Open Access publication charges for this article was provided by the Medical Research Council, United Kingdom [grant number wbs u.1300.00.004].

References

- 1 Sproston K, Primatesta PE. *Health Survey for England, 2003. Volume 2: Risk Factors for Cardiovascular Disease*. London: The Stationery Office, 2004.
- 2 Rehn N. *Global Status Report on Alcohol 2004*. Geneva: World Health Organization, 2004.
- 3 Royal College of Physicians. *A Great and Growing Evil: The Medical Consequences of Alcohol Abuse*. London: Royal College of Physicians, 1987.
- 4 Royal College of General Practitioners. *Alcohol: A Balanced View*. London: Royal College of General Practitioners, 1987.
- 5 British Medical Association. *Alcohol: Guidelines on Sensible Drinking*. London: British Medical Association, 1995.
- 6 Anon. *The Lord President's Report on Action Against Alcohol Misuse*. London: HMSO, 1991.
- 7 Anderson P, Cremona A, Paton A *et al*. The risk of alcohol. *Addiction* 1993;**88**(11):1493–508.
- 8 Britton A, McKee M, Leon D. *Cardiovascular Disease and Heavy Drinking: A Systematic Review*. London: PHP Publications, LSHTM, 1998.
- 9 Gronbaek M. Alcohol, type of alcohol, and all-cause and coronary heart disease mortality. *Ann N Y Acad Sci* 2002;**957**:16–20.
- 10 Poikolainen K. Alcohol and mortality: a review. *J Clin Epidemiol* 1995;**48**:455–65.
- 11 Sasaki S. Alcohol and its relation to all-cause and cardiovascular mortality. *Acta Cardiol* 2000;**55**(3):151–6.
- 12 Shaper AG. Alcohol and mortality: a review of prospective studies. *Br J Addict* 1990;**85**:837–47.
- 13 Norfolk A. Drink limits 'useless'. 7 October 2007; www.timesonline.co.uk/tol/life_and_style/food_and_drink/article2697975.ece (accessed on 10 February 2008).
- 14 Anon. *Safe. Sensible. Social. The Next Steps in the National Alcohol Strategy*. London: DH Publications, 2007.
- 15 Department of Health. *Sensible Drinking—The Report of an Inter-Departmental Working Group*. London: Department of Health, 1995.
- 16 The Academy of Medical Sciences. *Calling Time. The Nation's Drinking as a Major Health Issue*. London: The Academy of Medical Sciences, 2004.
- 17 Anon. *Revised Alcohol Consumption Estimates from the 2003 Scottish Health Survey*. 2008. <http://www.scotland.gov.uk/Resource/Doc/224573/0060598.pdf> (accessed 1 January 2009).
- 18 Ford G, Ecob R, Hunt K *et al*. Patterns of class inequality in health through the lifespan: class gradients at 15, 35 and 55 years in the west of Scotland. *Soc Sci Med* 1994;**39**(8):1037–50.
- 19 MacIntyre S, Annandale E, Ecob R *et al*. The West of Scotland Twenty-07 Study: health in the community. In: Martin C, MacQueen D (eds). *Readings for A New Public Health*. Edinburgh: Edinburgh University Press, 1989.
- 20 Goldberg D. *The Detection of Psychiatric Illness by Questionnaire*. London: Oxford University Press, 1972.
- 21 The sixth report of the Joint National Committee on prevention, detection, evaluation, and treatment of high blood pressure. *Arch Intern Med* 1997;**157**(21):2413–46.
- 22 Hunt K, Lewars H, Emslie C *et al*. Decreased risk of death from coronary heart disease amongst men with higher 'femininity' scores: a general population cohort study. *Int J Epidemiol* 2007;**36**(3):612–20.
- 23 World Health Organisation. *Physical status: the use and interpretation of anthropometry: report of a WHO expert committee. WHO Tech. Rep. Ser.* Geneva: WHO, 1995.
- 24 Anon. *Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death* (ninth revision). Geneva: WHO, 1977.
- 25 Anon. *International Statistical Classification of Diseases and Related Health Problems* (10th revision). Geneva: WHO, 1992.
- 26 OPCS. *Classification of Occupations 1980*. London: HMSO, 1980.
- 27 Cox DR. Regression models and life-tables. *J R Stat Soc (Ser B)* 1972;**34**:187–220.
- 28 Room R, Bondy SJ, Ferris J. The risk of harm to oneself from drinking, Canada 1989. *Addiction* 1995;**90**(4):499–513.
- 29 Der G. A comparison of the west of Scotland Twenty-07 study sample and the 1991 census SARs. Glasgow: MRC Medical Sociology Unit, 1998.
- 30 Yusuf S, Reddy S, Ounpuu S *et al*. Global burden of cardiovascular diseases: part I: general considerations, the epidemiologic transition, risk factors, and impact of urbanization. *Circulation* 2001;**104**(22):2746–53.
- 31 Rasul F, Stansfeld SA, Hart CL *et al*. Psychological distress, physical illness and mortality risk. *J Psychosom Res* 2004;**57**(3):231–6.
- 32 Shaper AG, Pocock SJ, Ashby D *et al*. Biochemical and haematological response to alcohol intake. *Ann Clin Biochem* 1985;**22**:50–61.
- 33 Gill JS, Donaghy M. Variation in the alcohol content of a 'drink' of wine and spirit poured by a sample of the Scottish population. *Health Educ Res* 2004;**19**(5):485–91.